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REGULATORY GUIDE 1.147

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INSERVICE INSPECTION CODE CASE ACCEPTABILITY, ASME SECTION XI, DIVISION 1

A. INTRODUCTION

General Design Criterion (GDC) 1, "Quality Standards and Records, " of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires, in part, that structures, systems, and components important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, Criterion 1 requires that they be identified and evaluated to determine their applicability, adequacy, and sufficiency and be supplemented or modified as necessary to ensure a quality product in keeping with the required safety function.

Provisions of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code have been used since 1971 as one part of the framework to establish the necessary design, fabrication, construction, testing, and performance requirements for structures, systems, and components important to safety. ASME standards committees develop, among other things, improved methods for the construction and inservice inspection (ISI) of ASME Class 1, 2, 3, MC (metal containment) and CC (concrete containment) nuclear power plant components. A broad spectrum of stakeholders participate in the ASME process, which helps to ensure that the various interests are considered.

Section 50.55a(g), "Inservice Inspection Requirements," requires, in part, that Classes 1, 2, 3, MC, and CC Components and their supports meet the requirements of Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components,"[1] of the ASME BPV Code

[1] Copies may be obtained from the American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990. Phone (212)591-8500; fax (212)591-8501; www.asme.org.

This guide was issued after consideration of comments received from the public. Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, to accommodate comments and to reflect new information or experience. Written comments may be submitted to the Rules and Directives Branch, ADM, U.S. Nuclear Regulatory Commission, DC 20555-0001.

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or equivalent quality standards. Every three years the ASME publishes a new edition of the BPV Code, including Section XI, and new addenda are published every year. The latest editions and addenda of Section XI that have been approved for use by the NRC are referenced in 10 CFR 50.55a(b). The ASME also publishes Code Cases quarterly. Code Cases provide alternatives to existing Code requirements that were developed and approved by the ASME. This regulatory guide identifies the Code Cases that have been determined by the NRC to be acceptable alternatives to applicable parts of Section XI. These Code Cases may be used by licensees without a request for authorization from the NRC, provided that they are used with any identified limitations or modifications. Section XI Code Cases not yet endorsed by the NRC may be implemented through 10 CFR 50.55a(a)(3), which permits the use of alternatives to the Code requirements referenced in 10 CFR 50.55a provided that the proposed alternatives result in an acceptable level of quality and safety and that their use is authorized by the Director of the Office of Nuclear Reactor Regulation.

The ASME Code is incorporated by reference into 10 CFR 50.55a. Code Cases approved by the NRC provide an acceptable voluntary alternative to the mandatory ASME Code provisions. 10 CFR 50.55a has been amended to incorporate this guide by reference and states the requirements governing the use of Code Cases. Because of the continuing change in the status of Code Cases, periodic updates to 10 CFR 50.55a and this guide are planned to accommodate new Code Cases and any revisions of existing Code Cases.

This regulatory guide would decrease the burden on licensees who choose to use ASME Code Cases N-532-1 and N-573. The public burden reduction for this information collection is estimated to average 32 hours per request. Because the burden for this information collection is insignificant, Office of Management and Budget (OMB) clearance is not required. Existing requirements were approved by OMB, approval number 3150-0011. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

B. DISCUSSION

For Revision 13 to Regulatory Guide 1.147, the NRC staff reviewed the Section XI Code Cases listed in Supplement 4 to the 1992 Edition through Supplement 11 to the 1998 Edition. It should be noted that, in response to public comments, several later revisions to Code Cases contained in Supplement 12 to the 1998 Edition and Supplements 2 and 3 to the 2001 Edition were adopted. Appendix A to this guide lists the supplements reviewed, the edition, supplement number, and the ASME's Board on Nuclear Codes and Standards approval date. Appendix B is a numerical list of the codes cases in these supplements. The guide lists Code Cases in four tables: Table 1, "Acceptable Section XI Code Cases," contains the Code Cases that are acceptable to the NRC for implementation in the ISI of light-water-cooled nuclear power plants; Table 2, "Conditionally Acceptable Section XI Code Cases," contains the Code Cases that are acceptable provided that they are used with the identified limitations or modifications, i.e., the Code Case is generally acceptable but the NRC has determined that the alternative requirements must be supplemented in order to provide an acceptable level of quality and safety; Table 3, "Annulled Section XI Code Cases," contains the Code Cases that have been annulled by the ASME and may no longer be used once an ISI program is updated; and Table 4, "Section XI Code Cases That Have Been Superseded," lists Code Cases that have been superseded through revision. ASME Code Cases that the NRC has determined to be unacceptable are listed in new Regulatory Guide 1.193, "ASME Code Cases Not Approved for Use."

Code Cases provide alternatives to existing Code requirements that were developed and approved by the ASME. The Code Cases listed as approved in Tables 1 and 2 of this guide have been incorporated by reference into 10 CFR 50.55a the. These Code Cases may be used voluntarily by licensees as an alternative to compliance with ASME Code provisions incorporated by reference into 10 CFR 50.55a.

10 CFR 50.55a requires that when a licensee initially implements a Code Case, the most recent version of that Code Case as listed in Tables 1 and 2 be implemented. If a Code Case is implemented by a licensee and a later version of the Code Case is incorporated by reference into 10 CFR 50.55a and listed in Tables 1 and 2 during the licensee's present 120-month ISI program interval, that licensee could use either the later version or the previous version. An exception to this provision would be the inclusion of a limitation or condition on the use of the Code Case which is necessary, for example, to enhance safety. Licensees who choose to continue use of the Code Case during the subsequent 120-month ISI program interval will be required to implement the latest version incorporated by reference into 10 CFR 50.55a and listed in Tables 1 and 2.

Code Cases may expire or be annulled because the provisions have been incorporated into the Code, the application for which it was specifically developed no longer exists, or experience has shown that an examination or testing method is no longer inadequate. After a Code Case is annulled and 10 CFR 50.55a and this guide are amended, licensees may not implement that Code Case for the first time. However, a licensee who implemented the Code Case prior to annulment may continue to use that Code Case through the end of the present ISI interval. An annulled Code Case cannot be used in the subsequent ISI interval unless implemented as an approved alternative under 10 CFR 50.55a(a)(3). If a Code Case is incorporated by reference into 10 CFR 50.55a and later annulled by the ASME because experience has shown that an examination or testing method is inadequate, the NRC will amend 10 CFR 50.55a and this guide to remove the approval of the annulled Code Case. Licensees should not begin to implement such annulled Code Cases in advance of the rulemaking. Notwithstanding these requirements, the Commission may impose new or revised Code requirements, including implementation schedules, that it determines are consistent with the backfit rule (i.e., 10 CFR 50.109).

With regard to the use of any Code Case, it is the responsibility of the user to make certain that the provisions of the Code Case do not conflict with regulatory requirements or licensee commitments.

C. REGULATORY POSITION

1. ACCEPTABLE SECTION XI CODE CASES

The Code Cases listed in the table below are acceptable to the NRC for application in licensees' Section XI inservice inspection programs. The ASME issues a new edition of Section XI every three years, and supplements to the edition containing Section XI Code Cases are published quarterly. Hence, there are 12 supplements to each edition. Column 3 of Table 1 lists the supplement and edition in which each Code Case was published (e.g., 7/95E means Code Case Supplement 7 to the 1995 Edition).

TABLE 1 - ACCEPTABLE SECTION XI CODE CASES

CODE CASE NUMBER	TABLE 1, ACCEPTABLE SECTION XI CODE CASES	SUPPLEMENT/ EDITION
N-198-1	*Exemption from Examination for ASME Class 1 and 2 Piping Located at Containment Penetrations, Section XI, Division 1*	12/95E
N-307-2	*Revised Ultrasonic Examination Volume for Class 1 Bolting, Table IWB-2500-1, Examination Category B-G-1, When the Examinations Are Conducted from the End of the Bolt or Stud or from the Center-Drilled Hole, Section XI, Division 1*	6/98E
N-311	*Alternative Examination of Outlet Nozzle on Secondary Side of Steam Generators, Section XI, Division 1*	3/98E
N-322	*Examination Requirements for Integrally Welded or Forged Attachments to Class 1 Piping at Containment Penetrations, Section XI, Division 1*	10/98E
N-334	*Examination Requirements for Integrally Welded or Forged Attachments to Class 2 Piping at Containment Penetrations, Section XI, Division 1*	10/98E
N-389-1	*Alternative Rules for Repairs, Replacements, or Modifications, Section XI, Division 1*	3/98E
N-408-3	*Alternative Rules for Examination of Class 2 Piping, Section XI, Division 1*	4/98E
N-432	*Repair Welding Using Automatic or Machine Gas Tungsten-Arc Welding (GTAW) Temper Bead Technique, Section XI, Division 1*	10/98E
N-435-1	*Alternative Examination Requirements for Vessels With Wall Thickness 2 in. Or Less, Section XI, Division 1*	12/95E
N-457	*Qualification Specimen Notch Location for Ultrasonic Examination of Bolts and Studs, Section XI, Division 1*	4/98E
N-458-1	*Magnetic Particle Examination of Coated Materials, Section XI, Division 1*	11/95E
N-460	*Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1*	9/98E
N-461-1	*Alternative Rules for Piping Calibration Block Thickness, Section XI, Division 1*	11/95E
N-463-1	*Evaluation Procedures and Acceptance Criteria for Flaws in Class 1 Ferritic Piping That Exceed the Acceptance Standards of IWB-3514.2, Section XI, Division 1*	12/95E

CODE CASE NUMBER	TABLE 1, ACCEPTABLE SECTION XI CODE CASES	SUPPLEMENT/ EDITION
N-471	*Acoustic Emission for Successive Inspections, Section XI, Division 1*	3/98E
N-479-1	*Boiling Water Reactor (BWR) Main Steam Hydrostatic Test, Section XI, Division 1*	3/98E
N-481	*Alternative Examination Requirements for Cast Austenitic Pump Casings, Section XI, Division 1*	1/98E
N-485-1	*Eddy Current Examination of Coated Ferritic Surfaces as an Alternative to Surface Examination, Section XI, Division 1*	9/98E
N-489	*Alternative Rules for Level III NDE Qualification Examinations, Section XI, Divisions 1, 2, and 3*	4/98E
N-490-1	*Alternative Vision Test Requirements for Nondestructive Examiners, Section XI, Divisions 1, 2, and 3*	9/98E
N-491-2	*Rules for Examination of Class 1, 2, 3, and MC Component Supports of Light-Water Cooled Power Plants, Section XI, Division 1*	9/98E
N-494-3	*Pipe Specific Evaluation Procedures and Acceptance Criteria for Flaws in Class 1 Ferritic Piping that Exceed the Acceptance Standards of IWB-3514.2 and in Class 1 Austenitic Piping that Exceed the Acceptance Standards of IWB-3514.3, Section XI, Division 1*	4/98E
N-495	*Hydrostatic Testing of Relief Valves, Section XI, Division 1*	3/98E
N-503	*Limited Certification of Nondestructive Examination Personnel, Section XI, Division 1* Note: Because of the statistical screening criteria used for Appendix VIII to Section XI qualifications, this Code Case is not applicable to Appendix VIII, “Performance Demonstration for Ultrasonic Examination Systems.”	10/98E
N-504-2	*Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping, Section XI, Division 1*	9/98E
N-508-1	*Rotation of Serviced Snubbers and Pressure Relief Valves for the Purpose of Testing, Section XI, Division 1*	9/98E
N-514	*Low Temperature Overpressure Protection, Section XI, Division 1*	3/98E
N-515	*Class 1 Mechanical Joint Pressure Tests, Section XI, Division 1*	3/98E

CODE CASE NUMBER	TABLE 1, ACCEPTABLE SECTION XI CODE CASES	SUPPLEMENT/ EDITION
N-521	*Alternative Rules for Deferral of Inspections of Nozzle-to-Vessel Welds, Inside Radius Sections, and Nozzle-to-Safe End Welds of a Pressurized Water Reactor (PWR) Vessel, Section XI, Division 1*	4/98E
N-522	*Pressure Testing of Containment Penetration Piping, Section XI, Division 1*	3/98E
N-523-2	*Mechanical Clamping Devices for Class 2 and 3 Piping, Section XI, Division 1*	11/98E
N-524	*Alternative Examination Requirements for Longitudinal Welds in Class 1 and 2 Piping, Section XI, Division 1*	4/98E
N-526	*Alternative Requirements for Successive Inspections of Class 1 and 2 Vessels, Section XI, Division 1*	6/98E
N-534	*Alternative Requirements for Pneumatic Pressure Testing, Section XI, Division 1*	10/98E
N-535	*Alternative Requirements for Inservice Inspection Intervals, Section XI, Division 1*	11/95E
N-537	*Location of Ultrasonic Depth-Sizing Flaws, Section XI, Division 1*	11/95E
N-538	*Alternative Requirements for Length Sizing Performance Demonstration in Accordance with Appendix VIII, Supplements 2, 3, 10, 11, and 12, Section XI, Division 1*	6/98E
N-541	*Alternative Requirements for Performance Demonstration in Accordance with Appendix VIII, Supplements 4 and 6, Section XI, Division 1*	12/95E
N-543	*Alternative to Performing Periodic Calibration Checks, Section XI, Division 1*	1/98E
N-544	*Repair/Replacement of Small Items, Section XI, Division 1*	1/98E
N-545	*Alternative Requirements for Conduct of Performance Demonstration Detection Test of Reactor Vessel, Section XI, Division 1*	1/98E
N-553	*Inservice Eddy Current Surface Examination of Pressure Retaining Pipe Welds and Nozzle-to-Safe End Welds, Section XI, Division 1*	3/98E
N-555	*Use of Section II, V, and IX Code Cases, Section XI, Division 1*	3/95E
N-556	*Alternative Requirements for Verification of Acceptability of Replacements, Section XI, Division 1*	4/98E

CODE CASE NUMBER	TABLE 1, ACCEPTABLE SECTION XI CODE CASES	SUPPLEMENT/ EDITION
N-563	*Grading of Examinations, IWA-2320, Section XI, Division 1*	4/98E
N-566-1	*Corrective Action for Leakage Identified at Bolted Connections, Section XI, Division 1*	3/98E
N-573	*Transfer of Procedure Qualification Records Between Owners, Section XI, Division 1*	8/95E
N-588	*Attenuation to Reference Flaw Orientation of Appendix G for Circumferential Welds in Reactor Vessels, Section XI, Division 1*	9/98E
N-592	*ASNT Central Certification Program, Section XI, Division 1*	11/95E
N-598	*Alternative Requirements to Required Percentages of Examinations, Section XI, Division 1*	12/95E
N-601	*Extent and Frequency of VT-3 Visual Examination for Inservice Inspection of Metal Containments, Section XI, Division 1*	12/95E
N-603	*Alternative to the Requirements of IWL-2421, Sites with Two Plants, Section XI, Division 1*	12/95E
N-604	*Alternative to Bolt Torque or Tension Test Requirements of Table IWE-2500-1, Category E-G, Item E8.20, Section XI, Division 1*	2/98E
N-605	*Alternative to the Requirements of IWE-2500(c) [sic, should state WE-2500(b)] for Augmented Examination of Surface Areas, Section XI, Division 1* [Note: Draft Regulatory Guide DG-1070, "Sampling Plans Used for Dedicating Simple Metallic Commercial Grade Items for Use in Nuclear Power Plants," is being developed to provide acceptable guidelines for sampling criteria.]	12/95E
N-609	*Alternative Requirements to Stress-Based Selection Criteria for Category B-J Welds, Section XI, Division 1*	2/98E
N-617	*Alternative Examination Distribution Requirements for Table IWC-2500-1, Examination Category C-G, Pressure Retaining Welds in Pumps and Valves, Section XI, Division 1*	3/98E
N-623	*Deferral of Inspections of Shell-to-Flange and Head-to-Flange Welds of a Reactor Vessel, Section XI, Division 1*	4/98E
N-624	*Successive Inspections, Section XI, Division 1*	8/98E
N-627	*VT-1 Visual Examination in Lieu of Surface Examination for RPV Closure Nuts, Section XI, Division 1*	5/98E

CODE CASE NUMBER	TABLE 1, ACCEPTABLE SECTION XI CODE CASES	SUPPLEMENT/ EDITION
N-629	*Use of Fracture Toughness Test Data to Establish Reference Temperature for Pressure Retaining Materials, Section XI, Division 1*	5/98E
N-638	*Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique, Section XI, Division 1*	6/98E
N-640	*Alternative Reference Fracture Toughness for Development of P-T Limit Curves, Section XI, Division 1*	4/98E
N-641	*Alternative Pressure-Temperature Relationship and Low Temperature Overpressure Protection System Requirements, Section XI, Division 1*	8/98E
N-643	*Fatigue Crack Growth Rate Curves for Ferritic Steels in PWR Water Environment, Section XI, Division 1*	10/98E

2. CONDITIONALLY ACCEPTABLE SECTION XI CODE CASES

The Code Cases listed in Table 2 below are acceptable to the NRC for application in licensees' Section XI inservice inspection programs within the limitations imposed by the NRC staff. Unless otherwise stated, limitations imposed by the NRC are in addition to the conditions specified in the Code Case. A new edition of Section XI is published every three years, and the ASME issues Section XI Code Cases quarterly in supplements to a specific edition. Hence, there are 12 supplements to each edition. Column 3 of the table lists the supplement and edition in which each Code Case was published (e.g., 7/95E means Code Case Supplement 7 to the 1995 Edition).

TABLE 2, CONDITIONALLY ACCEPTABLE SECTION XI CODE CASES

CODE CASE NUMBER	TABLE 2, CONDITIONALLY ACCEPTABLE SECTION XI CODE CASES	SUPPLEMENT/ EDITION
	CONDITION	
N-416-2	*Alternative Pressure Test Requirement for Welded Repairs or Installation of Replacement Items by Welding, Class 1, 2, and 3, Section XI, Division 1*	9/98E
	The provisions of IWA-5213, "Test Condition Holding Times," 1989 Edition, are to be used.	

CODE CASE NUMBER	TABLE 2, CONDITIONALLY ACCEPTABLE SECTION XI CODE CASES CONDITION	SUPPLEMENT/ EDITION
N-498-4	*Alternative Requirements for 10-Year System Hydrostatic Testing for Class 1, 2, and 3 Systems, Section XI, Division 1* The provisions of IWA-5213, "Test Condition Holding Times," 1989 Edition, are to be used.	3/98E
N-512-1	*Assessment of Reactor Vessels With Low Upper Shelf Charpy Impact Energy Levels, Section XI, Division 1* The material properties and transient selection must follow the guidance in Regulatory Guide 1.161, "Evaluation of Reactor Pressure Vessels with Charpy Upper-Shelf Energy Less Than 50 Ft-lb," or an equivalent method approved by the NRC staff.	1/98E
N-513	*Evaluation Criteria for Temporary Acceptance of Flaws in Class 3 Piping, Section XI, Division 1* (1) Specific safety factors in paragraph 4.0 must be satisfied. (2) Code Case N-513 may not be applied to: (a) Components other than pipe and tube. (b) Leakage through a gasket. (c) Threaded connections employing nonstructural seal welds for leakage prevention (through seal weld leakage is not a structural flaw; thread integrity must be maintained). (d) Degraded socket welds.	10/98E
N-516-2	*Underwater Welding, Section XI, Division 1* Licensees must obtain NRC approval in accordance with 10 CFR 50.55a(a)(3) regarding the technique to be used in the weld repair or replacement of irradiated material underwater.	8/98E
N-517-1	*Quality Assurance Program Requirements for Owners, Section XI, Division 1* The Owner's Quality Assurance (QA) Program that is approved under Appendix B to 10 CFR Part 50 must address the use of this Code Case and any unique QA requirements identified by the Code Case that are not contained in the owner's QA Program description. This would include the activities performed in accordance with this Code Case that are subject to monitoring by the Authorized Nuclear Inspector.	2/98E

CODE CASE NUMBER	TABLE 2, CONDITIONALLY ACCEPTABLE SECTION XI CODE CASES CONDITION	SUPPLEMENT/ EDITION
N-528-1	*Purchase, Exchange, or Transfer of Material Between Nuclear Plant Sites, Section XI, Division 1*	5/98E
	The requirements of 10 CFR Part 21 are to be applied to the nuclear plant site supplying the material as well as to the nuclear plant site receiving the material that has been purchased, exchanged, or transferred between sites.	
N-532-1	*Alternative Requirements to Repair and Replacement Documentation Requirements and Inservice Summary Report Preparation and Submission as Required by IWA-4000 and IWA-6000, Section XI, Division 1*	12/98E
	Code Case N-532-1 requires an Owner's Activity Report Form OAR-1 to be prepared and certified upon completion of each refueling outage. The OAR-1 forms must be submitted to the NRC within 90 days of the completion of the refueling outage.	
N-533-1	*Alternative Requirements for VT-2 Visual Examination of Class 1, 2, and 3 Insulated Pressure-Retaining Bolted Connections, Section XI, Division 1*	4/98E
	Prior to conducting the VT-2 examination, the provisions of IWA-5213, "Test Condition Holding Times," 1989 Edition, are to be followed.	
N-546	*Alternative Requirements for Qualification of VT-2 Examination Personnel, Section XI, Division 1*	1/98E
	(1) Qualify examination personnel by test to demonstrate knowledge of Section XI and plant specific procedures for VT-2 visual examination. (2) Requalify examination personnel by examination every three years. (3) This code case is applicable only to the performance of VT-2 examinations and may not be applied to other VT-2 functions such as verifying the adequacy of procedures and training VT-2 personnel.	

CODE CASE NUMBER	TABLE 2, CONDITIONALLY ACCEPTABLE SECTION XI CODE CASES CONDITION	SUPPLEMENT/ EDITION
N-552	*Alternative Methods - Qualification for Nozzle Inside Radius Section from the Outside Surface, Section XI, Division 1*	3/98E
	To achieve consistency with the 10 CFR 50.55a rule change published September 22, 1999 (64 FR 51370), incorporating Appendix VIII, “Performance Demonstration for Ultrasonic Examination Systems,” to Section XI, add the following to the specimen requirements: "At least 50 percent of the flaws in the demonstration test set must be cracks and the maximum misorientation must be demonstrated with cracks. Flaws in nozzles with bore diameters equal to or less than 4 inches may be notches. Add to detection criteria, “The number of false calls must not exceed three.”	
N-554-2	*Alternative Requirements for Reconciliation of Replacement Items and Addition of New Systems, Section XI, Division 1*	9/98E
	The component used for repair/replacement must be manufactured, procured, and controlled as a safety-related component under an NRC-approved Quality Assurance program meeting the requirements of Appendix B to 10 CFR Part 50.	
N-557-1	*In-Place Dry Annealing of a PWR Nuclear Reactor Vessel, Section XI, Division 1*	4/98E
	The secondary stress allowable of $3S_m$, shown in Figure 1 of the Code Case, must be applied to the entire primary plus secondary stress range during the anneal.	
N-567-1	*Alternative Requirements for Class 1, 2, and 3 Replacement Components, Section XI, Division 1*	4/98E
	The component used for repair/replacement must have been manufactured, procured, and controlled as a safety-related component under an NRC-approved Quality Assurance program meeting the requirements of Appendix B to 10 CFR Part 50.	

CODE CASE NUMBER	TABLE 2, CONDITIONALLY ACCEPTABLE SECTION XI CODE CASES CONDITION	SUPPLEMENT/ EDITION
N-568	*Alternative Examination Requirements for Welded Attachments, Section XI, Division 1*	8/98E
	This Code Case may only be used for examination of the accessible portions of lugs on piping where riser clamps (i.e., clamps on vertical runs of pipe) obstruct access to welded surfaces.	
N-569-1	*Alternative Rules for Repair by Electrochemical Deposition of Class 1 and 2 Steam Generator Tubing, Section XI, Division 1*	5/98E
	NOTES: Steam generator tube repair methods require prior NRC approval through the Technical Specifications. This Code Case does not address certain aspects of this repair, e.g., the qualification of the inspection and plugging criteria necessary for staff approval of the repair method. In addition, if the user plans to "reconcile," as described in Footnote 2, the reconciliation is to be performed in accordance with IWA-4200 in the 1995 Edition, 1996 Addenda of ASME Section XI.	
N-576-1	*Repair of Class 1 and 2 SB-163, UNS N06600 Steam Generator Tubing, Section XI, Division 1*	5/98E
	NOTES: Steam generator tube repair methods require prior NRC approval through the Technical Specifications. This Code Case does not address certain aspects of this repair, e.g., the qualification of inspection and plugging criteria necessary for staff approval of the repair method. In addition, if the user plans to "reconcile," as described in the footnote, the reconciliation is to be performed in accordance with IWA-4200 in the 1995 Edition, 1996 Addenda of ASME Section XI.	
N-583	*Annual Training Alternative, Section XI, Division 1*	10/98E
	(1) Supplemental practice shall be performed on material or welds that contain cracks, or by analyzing prerecorded data from material or welds that contain cracks. (2) The training must be completed no earlier than 6 months prior to performing ultrasonic examinations at a licensee's facility.	

CODE CASE NUMBER	TABLE 2, CONDITIONALLY ACCEPTABLE SECTION XI CODE CASES CONDITION	SUPPLEMENT/ EDITION
N-586	*Alternative Additional Examination Requirements for Class 1, 2, and 3 Piping, Components, and Supports, Section XI, Division 1*	5/98E
	The engineering evaluations addressed under Item (a) and the additional examinations addressed under Item (b) shall be performed during this outage. If the additional examinations performed under Item (b) reveal indications exceeding the applicable acceptance criteria of Section XI, the engineering evaluations and the examinations shall be further extended to included additional evaluations and examinations at this outage.	
N-593	*Alternative Examination Requirements for Steam Generator Nozzle to Vessel Welds, Section XI, Division 1*	11/98E
	Essentially 100 percent (not less than 90 percent) of the examination volume A-B-C-D-E-F-G-H must be inspected.	
N-597-1	*Requirements for Analytical Evaluation of Pipe Wall Thinning, Section XI, Division 1*	2/01E
	(1) Code Case must be supplemented by the provisions of EPRI Nuclear Safety Analysis Center Report 202L-R2, April 1999, "Recommendations for an Effective Flow Accelerated Corrosion Program," for developing the inspection requirements, the method of predicting the rate of wall thickness loss, and the value of the predicted remaining wall thickness. As used in NSAC-202L-R2, the terms "should" and "shall" have the same expectation of being completed. (2) Components affected by flow-accelerated corrosion to which this Code Case are applied must be repaired or replaced in accordance with the construction code of record and Owner's requirements or a later NRC approved edition of Section III of the ASME Code prior to the value of t_p reaching the allowable minimum wall thickness, t_{min}, as specified in -3622.1(a)(1) of this Code Case. Alternatively, use of the Code Case is subject to NRC review and approval. (3) For Class 1 piping not meeting the criteria of -3221, the use of evaluation methods and criteria is subject to NRC review and approval. (4) For those components that do not require immediate repair or replacement, the rate of wall thickness loss is to be used to determine a suitable inspection frequency so that repair or replacement occurs prior to reaching allowable minimum wall thickness, t_{min}.	

CODE CASE NUMBER	TABLE 2, CONDITIONALLY ACCEPTABLE SECTION XI CODE CASES CONDITION	SUPPLEMENT/ EDITION
N-597-1 (continued)	*Requirements for Analytical Evaluation of Pipe Wall Thinning, Section XI, Division 1*	2/01E
	(5) For corrosion phenomenon other than flow accelerated corrosion, use of the Code Case is subject to NRC review and approval. Inspection plans and wall thinning rates may be difficult to justify for certain degradation mechanisms such as MIC and pitting.	
N-599	*Alternatives to Qualification of Nondestructive Examination Personnel for Inservice Inspection of Metal (Class MC) and Concrete (Class CC) Containments, Section XI, Division 1*	2/98E
	This Code Case may not be used when a licensee updates to the 1992 or later Edition of Section XI that requires the use of ANSI/ASNT CP-189, "Standard for Qualification and Certification of Nondestructive Testing Personnel."	
N-606-1	*Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique for BWR CRD Housing/Stub Tube Repairs, Section XI, Division 1*	6/98E
	Prior to welding, an examination or verification must be performed to ensure proper preparation of the base metal, and that the surface is properly contoured so that an acceptable weld can be produced. The surfaces to be welded, and surfaces adjacent to the weld, are to be free from contaminants, such as, rust, moisture, grease, and other foreign material or any other condition that would prevent proper welding and adversely affect the quality or strength of the weld. This verification is to be required in the welding procedures.	
N-616	*Alternative Requirements for VT-2 Visual Examination of Classes 1, 2, 3 Insulated Pressure Retaining Bolted Connections, Section XI, Division 1*	6/98E
	(1) Insulation must be removed for VT-2 examination during the system pressure test for any 17-4 PH stainless steel of 410 stainless steel stud or bolt aged at a temperature below 1100°F or with hardness above R_c 30. (2) For A-286 stainless steel studs or bolts, the preload must be verified to be below 100 Ksi or the thermal insulation must be removed and the joint visually examined. (3) For nuts conforming to SA-194, removal of the insulation for visual inspection is not necessary. (4) Prior to conducting the VT-2 examination, the provisions of IWA-5213, "Test Condition Holding Times," 1989 Edition, are to be followed.	

CODE CASE NUMBER	TABLE 2, CONDITIONALLY ACCEPTABLE SECTION XI CODE CASES CONDITION	SUPPLEMENT/ EDITION
N-619	*Alternative Requirements for Nozzle Inner Radius Inspections for Class 1 Pressurizer and Steam Generator Nozzles, Section XI, Division 1*	3/98E
	In lieu of a UT examination, licensees may perform a visual examination with enhanced magnification that has a resolution sensitivity to detect a 1-mil width wire or crack, utilizing the allowable flaw length criteria of Table IWB-3512-1 with limiting assumptions on the flaw aspect ratio. The provisions of Table IWB-2500-1, Examination Category B-D, continue to apply except that, in place of examination volumes, the surfaces to be examined are the external surfaces shown in the figures applicable to this table.	
N-630	*Alternatives to VT-1C and VT-3C Visual Examination for Inservice Inspection of Concrete and VT-1 Visual Examination for Inservice Inspection of Anchorage Hardware and Surrounding Concrete for Concrete Containments, Section XI, Division 1*	5/98E
	The Responsible Engineer's written practice must define qualification requirements for concrete and tendon hardware examination personnel in accordance with IWA-2300 in lieu of the Owner defined qualification requirements specified in Paragraph (c) of the Code Case. However, limited certification in accordance with IWA-2350 is permitted.	
N-639	*Alternative Calibration Block Material, Section XI, Division 1*	6/98E
	Chemical ranges of the calibration block may vary from the materials specification if: (1) the calibration block material is produced under an accepted industry specification or standard, and (2) the phase and grain shape are maintained in the same ranges produced by the thermal process required by the material specification.	
N-647	*Alternative to Augmented Examination Requirements of IWE-2500, Section XI, Division 1*	11/98E
	A VT-1 examination is to be used in lieu of the "detailed visual examination." [Note: Draft Regulatory Guide DG-1070, "Sampling Plans Used for Dedicating Simple Metallic Commercial Grade Items for Use in Nuclear Power Plants," is being developed to provide acceptable guidelines for sampling criteria.]	

CODE CASE NUMBER	TABLE 2, CONDITIONALLY ACCEPTABLE SECTION XI CODE CASES CONDITION	SUPPLEMENT/ EDITION
N-648-1	*Alternative Requirements for Inner Radius Examination of Class 1 Reactor Vessel Nozzles, Section XI Division 1* In place of a UT examination, licensees may perform a visual examination with enhanced magnification that has a resolution sensitivity to detect a 1-mil width wire or crack, utilizing the allowable flaw length criteria of Table IWB-3512-1 with limiting assumptions on the flaw aspect ratio. The provisions of Table IWB-2500-1, Examination Category B-D, continue to apply except that, in place of examination volumes, the surfaces to be examined are the external surfaces shown in the figures applicable to this table.	03/01

3. ANNULLED CODE CASES

Table 3 lists the Section XI Code Cases contained in Supplement 4 to the 1992 Edition through Supplement 11 to the 1998 Edition that were annulled by the ASME.

TABLE 3, ANNULLED SECTION XI CODE CASES

CODE CASE NUMBER	TABLE 3, ANNULLED SECTION XI CODE CASES	ANNULMENT DATE (SUPPLEMENT/ EDITION)
N-98	*Ultrasonic Examination - Calibration Block Tolerances, Section XI, Division 1*	8/9/96 (6/95E)
N-113-1	*Basic Calibration Block for Ultrasonic Examination of Weld 10 in. To 14 in. Thick, Section XI, Division 1*	8/9/96 (6/95E)
N-211	*Recalibration of Ultrasonic Equipment Upon Change of Personnel, Section XI, Division 1*	4/30/96 (5/95E)
N-235	*Ultrasonic Calibration Checks per Section V, Section XI, Division 1*	8/9/96 (6/95E)
N-236-1	*Repair and Replacement of Class MC Vessels, Section XI, Division 1*	8/5/97 (9/95E)
N-335-1	*Rules for Ultrasonic Examination of Similar and Dissimilar Metal Piping Welds, Section XI, Division 1*	5/11/97 (9/95E)
N-355	*Calibration Block for Angle Beam Ultrasonic Examination of Large Fittings in Accordance with Appendix III-3410, Section XI, Division 1*	8/9/96 (6/95E)

CODE CASE NUMBER	TABLE 3, ANNULLED SECTION XI CODE CASES	ANNULMENT DATE (SUPPLEMENT/ EDITION)
N-356	*Certification Period for Level III NDE Personnel, Section XI, Division 1*	8/5/97 (9/95E)
N-401-1	*Eddy Current Examination, Section XI, Division 1*	5/11/97 (8/95E)
N-402-1	*Eddy Current Calibration Standards, Section XI, Division 1*	5/11/97 (8/95E)
N-409-3	*Procedure and Personnel Qualification Requirements for Ultrasonic Detection and Sizing of Flaws in Piping Welds, Section XI, Division 1*	4/30/96 (5/95E)
N-415	*Alternative Rules for Testing Pressure Relief, Section XI, Division 1*	8/14/94 (10/92E)
N-419	*Extent of VT-1 Examinations, Category B-G-1 of Table IWB-2500-1, Section XI, Division 1*	5/13/94 (9/92E)
N-426	*Extent of VT-1 Examinations, Category B-G-2 of Table IWB-2500-1, Section XI, Division 1*	5/13/94 (9/92E)
N-427	*Code Cases in Inspection Plans, Section XI, Division 1*	12/16/94 (11/92E)
N-429-1	*Alternative Rules for Ultrasonic Instrument Calibration, Section XI, Division 1*	7/27/95 (1/95E)
N-437	*Use of Digital Readout and Digital Measurement Devices for Performing Pressure Tests, Section XI, Division 1*	7/27/95 (1/95E)
N-448	*Qualification of VT-2 and VT-3 Visual Examination Personnel, Section XI, Division 1*	4/30/96 (5/95E)
N-449	*Qualification of VT-4 Visual Examination Personnel, Section XI, Division 1*	4/30/96 (5/95E)
N-472	*Use of Digital Readout and Digital Measurement Devices for Performing Pump Vibration Testing, Section XI, Division 1*	8/14/97 (10/95E)
N-473	*Alternative Rules for Valve Testing, Section XI, Division 1*	12/16/94 (11/92E)
N-478	*Inservice Inspection for Class CC Concrete Components of Light-Water Cooled Power Plants, Section XI, Division 1*	3/2/98 (12/95E)
N-496-1	*Helical-Coil Threaded Inserts, Section XI, Division 1*	5/11/97 (8/95E)

CODE CASE NUMBER	TABLE 3, ANNULLED SECTION XI CODE CASES	ANNULMENT DATE (SUPPLEMENT/ EDITION)
N-509	*Alternative Rules for the Selection and Examination of Class 1, 2, and 3 Integrally Welded Attachments, Section XI, Division 1*	5/20/01 (1/98E)

4. CODE CASES THAT HAVE BEEN SUPERSEDED

Table 4 lists Code Cases that have been superseded by revised Code Cases. Column 3 indicates the date on which each Code Case was superseded as well as whether it was approved in a previous version of this guide, the supplement in which the Code Case was reaffirmed, and the date that the ASME approved the revised Code Case. Note: Some of these Code Cases were not approved for use by the NRC in previous versions of Regulatory Guide 1.147.

TABLE 4 - SECTION XI CODE CASES THAT HAVE BEEN SUPERSEDED

CODE CASE NUMBER	TABLE 4, SECTION XI CODE CASES THAT HAVE BEEN SUPERSEDED	DATE
N-307-1	*Revised Ultrasonic Examination Volume for Class 1 Bolting, Table IWB-2500-1, Examination Category B-G-1, When the Examinations Are Conducted from the Center-Drilled Hole, Section XI, Division 1*	Approved Rev. 12; Reaffirmed 4/98E; N-307-2 Published on 9/24/99
N-408-2	*Alternative Rules for Examination of Class 2 Piping, Section XI, Division 1*	Approved Rev. 11; Reaffirmed 8/95E; N-408-3 Published on 8/9/93
N-416-1	*Alternative Pressure Test Requirements for Welded Repairs or Installation of Replacement Items by Welding, Class 1, 2, and 3, Section XI, Division 1*	Approved Rev. 12; Reaffirmed 8/92E; N-416-2 Published on 5/5/00
N-458	*Magnetic Particle Examination of Coated Materials, Section XI, Division 1*	Approved Rev. 12; Reaffirmed 4/30/93 N-458-1 Published on 3/14/95
N-461	*Alternative Rules for Piping Calibration Block Thickness, Section XI, Division 1*	Approved Rev. 12; Reaffirmed 4/30/93 N-461-1 Published on 3/14/95

CODE CASE NUMBER	TABLE 4, SECTION XI CODE CASES THAT HAVE BEEN SUPERSEDED	DATE
N-465	*Alternative Rules for Pump Testing, Section XI, Division 1*	Approved Rev. 12; Annulled 10/92E; N-465-1 Published on 8/14/97
N-491-1	*Alternative Rules for Examination of Class 1, 2, 3, and MC Component Supports of Light-Water Cooled Power Plants, Section XI, Division 1*	Approved Rev. 12; Reaffirmed 5/95E; N-491-2 Published on 3/12/97
N-494-2	*Pipe Specific Evaluation Procedures and Acceptance Criteria for Flaws in Class 1 Ferritic Piping that Exceed the Acceptance Standards of IWB-3514.2, Section XI, Division 1*	Approved Rev. 12; Published 7/92E; N-494-3 Published on 8/9/96
N-496	*Helical-Coil Threaded Inserts, Section XI, Division 1*	Approved Rev. 11; Reaffirmed 7/92E; N-496-1 Published on 5/11/94; N-496-1 Annulled on 5/11/97
N-498 N-498-1 N-498-2 N-498-3	*Alternative Rules for 10-Year System Hydrostatic Testing for Class 1, 2, and 3 Systems, Section XI, Division 1*	Reaffirmed on 5/13/91 Published 5/11/94 Published 1/95E Published 1/98E
N-504-1	*Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping, Section XI, Division 1*	Approved Rev. 12; Published 6/92E; N-504-2 Published on 3/12/97
N-508	*Rotation of Serviced Snubbers and Pressure Relief Valves for the Purpose of Testing, Section XI, Division 1*	Published in 4/92E; N-508-1 Published on 5/11/94
N-512	*Assessment of Reactor Vessels With Low Upper Shelf Charpy Impact Energy Levels, Section XI, Division 1*	Published in 4/92E; N-512-1 Published on 8/24/95
N-516 N-516-1	*Underwater Welding, Section XI, Division 1*	N-516 Approved Rev. 12; Reaffirmed 6/95E; N-516-1 Published on 12/31/96; N-516-2 Published on 1/17/00
N-517	*Quality Assurance Program Requirements for Owners, Section XI, Division 1*	Approved Rev. 12: Reaffirmed 8/95E; N-517-1 Published on 7/30/98

CODE CASE NUMBER	TABLE 4, SECTION XI CODE CASES THAT HAVE BEEN SUPERSEDED	DATE
N-523 N-523-1	*Mechanical Clamping Devices for Class 2 and 3 Piping, Section XI, Division 1*	Published 10/92E; N-523-1 Published on 8/24/95 N-523-2 Published on 10/2/00
N-528	*Purchase, Exchange, or Transfer of Material Between Nuclear Plant Sites, Section XI, Division 1*	Reaffirmed 10/95E; N-528-1 Published on 5/7/99
N-532	*Alternative Requirements to Repair and Replacement Documentation Requirements and Inservice Summary Report Preparation and Submission as Required by IWA-4000 and IWA-6000, Section XI, Division 1*	Published 12/98E
N-533	*Alternative Requirements for VT-2 Visual Examination of Class 1 Insulated Pressure-Retaining Bolted Connections, Section XI, Division 1*	Reaffirmed 11/95E; N-533-1 Published 2/26/99
N-554 N-554-1	*Alternative Requirements for Reconciliation of Replacement Items, Section XI, Division 1*	N-554 Reaffirmed 3/98E; N-554-1 Published 7/98E; N-554-2 Published on 2/25/00
N-557	*In-Place Dry Annealing of a PWR Nuclear Reactor Vessel, Section XI, Division 1*	Published 4/95E; N-557-1 Published on 12/31/96
N-560 N-560-1	*Alternative Examination Requirements for Class 1, Category B-J Piping Welds, Section XI, Division 1*	N-560 Published 6/98E; N-560-1 Published 7/98E; N-560-2 Published on 3/28/00
N-561	*Alternative Requirements for Wall Thickness Restoration of Class 2 and High Energy Class 3 Carbon Steel Piping, Section XI, Division 1*	Published 7/95E; N-561-1 Published on 7/30/98
N-562	*Alternative Requirements for Wall Thickness Restoration of Class 3 Moderate Energy Carbon Steel Piping, Section XI, Division 1*	Published 7/95E; N-562-1 Published on 7/30/98
N-566	*Corrective Action for Leakage Identified at Bolted Connections, Section XI, Division 1*	Published 6/98E; N-566-1 Published on 2/15/99
N-567	*Alternative Requirements for Class 1, 2, and 3 Replacement Components, Section XI, Division 1*	Published 10/95E; N-567-1 Published on 2/26/99

CODE CASE NUMBER	TABLE 4, SECTION XI CODE CASES THAT HAVE BEEN SUPERSEDED	DATE
N-569	*Alternative Rules for Repair by Electrochemical Deposition of Class 1 and 2 Steam Generator Tubing, Section XI, Division 1*	Published 6/95E; N-569-1 Published on 5/7/99
N-576	*Repair of Class 1 and 2 SB-163, UNS N06600 Steam Generator Tubing, Section XI, Division 1*	Published 8/95E; N-576-1 Published on 5/7/99
N-577	*Risk-Informed Requirements for Class 1, 2, and 3 Piping, Method A, Section XI, Division 1*	Published 10/95E; N-577-1 Published on 3/28/00
N-578	*Risk-Informed Requirements for Class 1, 2, and 3 Piping, Method B, Section XI, Division 1*	Published 10/95E; N-578-1 Published on 3/28/00
N-606	*Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique, Section XI, Division 1*	Published 12/95E; N-606-1 Published on 9/24/99
N-648	*Alternative Requirements for Inner Radius Examination of Class 1 Reactor Vessel Nozzles, Section XI Division 1*	Published 11/98E

APPENDIX A

SUPPLEMENTS ADDRESSED IN PROPOSED REVISION 13
TO REGULATORY GUIDE 1.147

EDITION	SUPPLEMENT NUMBER	BNCS[a] APPROVAL DATE OF CODE CASES IN SUPPLEMENT[b]
1992	4	February 12, 1993
1992	5	April 27, 1993
1992	6	August 9, 1993
1992	7	December 9, 1993
1992	8	February 15, 1994
1992	9	May 11, 1994
1992	10	August 5, 1994
1992	11	December 12, 1994
1992	12	March 14, 1995
1995	1	June 9, 1995
1995	2	August 24, 1995
1995	3	December 12, 1995
1995	4	March 19, 1996
1995	5	May 24, 1996
1995	6	August 9, 1996
1995	7	December 31, 1996
1995	8	March 12, 1997
1995	9	May 26, 1997
1995	10	August 14, 1997
1995	11	December 12, 1997
1995	12	March 2, 1998
1998	1	May 20, 1998
1998	2	July 30, 1998
1998	3	February 15, 1999

EDITION	SUPPLEMENT NUMBER	BNCS[a] APPROVAL DATE OF CODE CASES IN SUPPLEMENT[b]
1998	4	February 26, 1999
1998	5	May 7, 1999
1998	6	September 24, 1999
1998	7	November 11, 1999
1998	8	January 17, 2000
1998	9	March 28, 2000
1998	10	October 2, 2000
1998	11	December 8, 2000

[a] BNCS - ASME Board on Nuclear Codes and Standards
[b] Publication generally is 3 months after BNCS approval.

Appendix B

Numerical Listing of Section XI Code Cases
in Supplement 4, 1992 Edition, through Supplement 11, 1998 Edition

N-98
N-113-1
N-198-1
N-211
N-235
N-236-1
N-307-1
N-307-2
N-311
N-322
N-323-1[1]
N-334
N-335-1
N-356
N-389-1
N-401-1
N-402-1
N-408-2
N-408-3
N-409-3
N-415
N-416-1
N-416-2
N-419
N-426
N-427
N-429-1
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N-435-1
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N-458-1
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N-643
N-647
N-648-1[4]

[1] Code Case is not acceptable for use. See Regulatory Guide 1.193.

[2] Code Case N-532-1 is listed in Supplement 12 to the 1998 Edition.

[3] Code Case N-597-1 is listed in Supplement 2 to the 2001 Edition.

[4] Code Case N-648-1 is listed in Supplement 3 to the 2001 Edition.

REGULATORY ANALYSIS

A separate regulatory analysis was not prepared for this regulatory guide. The regulatory basis for this guide is the regulatory analysis prepared for the amendment to 10 CFR 50.55a, "Codes and Standards," that incorporates this regulatory guide by reference.

A copy of the regulatory analysis is available for inspection and/or copying for a fee in the NRC's Public Document Room at 11555 Rockville Pike, Public File Area (O-1F21), Rockville, MD. The PDR's mailing address is USNRC PDR, Washington, DC 20555-0001; telephone (301)415-4737 or 1-(800)397-4209; fax (301)415-3548; e-mail <PDR@NRC.GOV>. The regulatory analysis is also available through the NRC's Electronic Reading Room under accession number ML031490533.